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Risk Estimation of Breast Cancer

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Abstract:

Breast cancer is cancer that develops from breast tissue and is the leading type of cancer in women. Several methods have been introduced to predict the risk of developing breast cancer which include but not limited to; single-nucleotide polymorphisms, mammographic density, and hormone measurements. single-nucleotide polymorphisms can be responsible for a large percentage of cancers in the population and it can be determined by the patients' polygenic risk score which found that Women in the highest 1% of the polygenic risk score had a three-fold increased risk of developing breast cancer. Mammographic feature studies pointed out that women with 70% or more density was 4.64-fold at greater risk for developing breast cancer. Hormone measurement studies indicated that excess levels of hormones other than estradiol, free estradiol, progesterone and sex hormone binding globulin, such as testosterone and free testosterone were associated with an increased overall risk of breast cancer.

Introduction:

Breast cancer is cancer that develops from breast tissue. Signs of breast cancer may include a lump in the breast, a change in breast shape, dimpling of the skin, fluid coming from the nipple, or a red scaly patch of skin.¹

Outcomes for breast cancer vary depending on the cancer type, extent of disease, and person's age. Survival rates in the developed world are high, with between 80% and 90% of those in England and the United States alive for at least 5 years. In developing countries survival rates are poorer. Worldwide, breast cancer is the leading type of cancer in women, accounting for 25% of all cases. In 2012, it resulted in 1.68 million new cases and 522,000 deaths.² Breast cancer is an increasing public health problem, as substantial advances have been made in the treatment of breast cancer, but the introduction of methods to predict women at elevated risk and prevent the disease has been less successful. The aim of this report is to summarize recent data on newer approaches to risk prediction, and available approaches to prevention.

Discussion:

Methods of risk assessment - single-nucleotide polymorphisms (SNPs), mammographic density, and hormone measurements:

It is well established that inherited mutations in BRCA1 and BRCA2 can predispose women to this disease, as well as to ovarian cancer. Changes in other genes, such as p53, PTEN, or CHEK2, are also associated with increased risk of breast cancer.³ Mutations in high-risk breast cancer genes such as *BRCA1/2* affect only small numbers of women, whereas variation in lower-impact, common susceptibility loci or SNPs can be responsible for a larger percentage of cancers in the population.⁴ One study investigated the value of using 77 breast cancer-associated SNPs for risk stratification, in a study of 33,673 breast cancer cases and 33,381 control women of European origin. The results found that Women in the highest 1% of the polygenic risk score (PRS) had a three-fold increased risk of developing breast cancer compared with women in the middle quintile and lifetime risk of breast cancer for women in the lowest and highest quintiles of the PRS were 5.2% and 16.6% for a woman without family history, and 8.6% and 24.4% for a woman with a first-degree family history of breast cancer.⁶

Mammographic features are associated with breast cancer risk, dense tissue on the mammogram is white, whereas fat tissue is radio-lucent and appears black. A meta-analysis of 42 studies of

visually assessed mammographic density (the proportion of the breast as a percentage which appears white) indicated that the relative risk of breast cancer for women with 70% or more density was 4.64-fold greater compared with women with less than 5% density.⁷

Hormone Measurements - The Endogenous Hormones and Breast Cancer Collaborative Group (EHBCCG) reported that risk of breast cancer was related to steroid hormones such as estradiol, testosterone, and sex hormone-binding globulin (SHBG) in pre- and post-menopausal women. According to a study conducted in 2014 which included a cohort of 801 breast cancer cases and 1,132 matched control subjects found that higher pre-diagnostic serum levels of testosterone and free testosterone were associated with an increased overall risk of breast cancer, but no significant risk association was observed for estradiol, free estradiol, progesterone and SHBG.⁸

Conclusion:

In conclusion, breast cancer is considered a leading type of cancer in women and specific mutations in specific genes such as BRCA1/2 is well established, but studies showed that single nucleotide polymorphisms in multiple small impact loci are suspected to play a major role in the development of the cancer. Other factors that determined the risk of developing breast cancer included mammographic features and hormone measurements which showed, respectively, that increased mammographic density and higher than normal levels of steroid hormones contributed to the overall risk of developing breast cancer.

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